International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN (P): 2249-6890; ISSN (E): 2249-8001
Vol. 7, Issue 5, Oct 2017, 155-160




# A CASE STUDY ON IMPROVEMENT OF PLANT LAYOUT FOR EFFECTIVE PRODUCTION

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***ABSTRACT***

***This study aims to improve the existing plant layout for Tushar Engineering and Works, Nagpur. The final solution for a plant layout has designed to balance among the characteristics and considerations of all factors, affecting plant layout in order to get the maximum advantages.***

***KEYWORDS: Facility Layout, Existing Layout, Proposed Layout & Miscellaneous Time***

**Received:** Aug 14, 2017**; Accepted:** Sep 04, 2017**; Published:** Sep 13, 2017**; Paper Id.:** IJMPERDOCT201716

A Case Study

## INTRODUCTION

Layout design involves a systematic physical arrangement of different departments, work stations, machines, equipments, storage areas and common areas, in a manufacturing industry. In today's competitive global environment, the optimum facility layout has become an effective tool in cost reduction, by enhancing the productivity. It has become very essential to have a well-organized plant layout, for all available resources in an optimum manner, to achieve the maximum returns.

## OBJECTIVE OF THE WORK

To design a new plant layout with the aim of organization of machines and working areas, in the most efficient way and at the same time satisfactory and safety for the personnel doing the work.

## PROBLEM STATEMENT

In the present work, existing facility layout of the industry has studied in detail, which shows unutilized spaces. The present layout supports 10 % of the production, most of the processes for the products are the same, but the present layout has designed for the product that accounts for10% of the total annual production and due to this, the material handling cost has increased for the product, that has 90% of the annual production.

## OVERVIEW OF EXISTING PLANT LAYOUT

Figure 1, shows an existing plant layout. The material handling time is the important criterion for the analysis and selection of existing plant layout. For the development of new plant layout, following procedure has been followed:

**Step 1:** Summarization of interdepartmental moves of existing plant layout.

**Step 2:** Simplifying moves and countermoves among departments.

**Step 3:** Preparation of the material handling cost matrix of the existing layout by multiplying the unit material handling costs by the number of moves among various departments.

**Step 4:** Calculation of total material handling cost of the existing layout.

**Step 5:** Changes in location of departments, that will reduce the number of moves and calculation of total material handling time.

**QRST Analysis**

Layout design begins with PQRST analysis, for the overall production activities. This includes P (product), Q (quantitative), R (routing), S (supporting) and T (time). The company manufactures various types of products. These products have more than 10 categories, which differ in physical size, structure (geometry), along with functional design and components. Thus, the existing layout dimensions, equipment, utilities, number of workers and machinery involved.

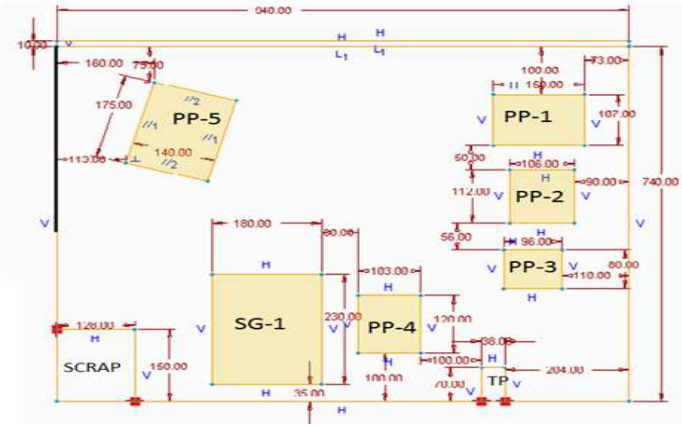


**Figure 1: Existing Plant Layout**

All dimensions are in feet.

**Materials Flow Analysis**

This step involves the analysis of the flow of materials, throughout the production. In this step, from-to chart is constructed, which represents the flow intensity and interaction between different production machines, as explained in figure 2.

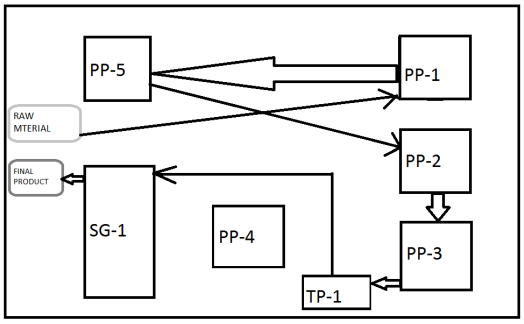


**Figure 2: Material Flow Analysis**

PP-1 = Power Press (Shearing) PP-5 = Power Press (Bending)

PP-2 = Power Press (Piercing) TP-1 = Tapping Press

PP-3 = Power Press (Bending) SG-1 = Surface Grinding

PP-4 = Power Press (Piercing)

## PROPOSED PLANT LAYOUT

### Design (Material Flow)

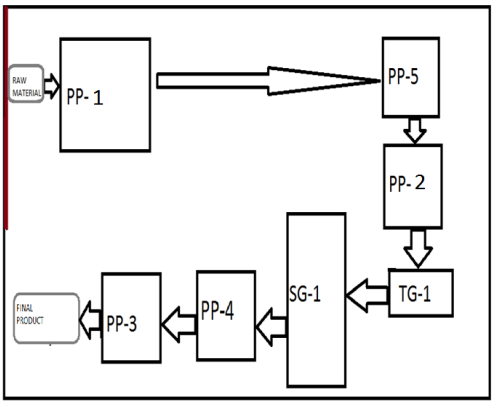


**Figure 3: Design of New Layout (Material Flow)**

### Proposed New Plant Layout

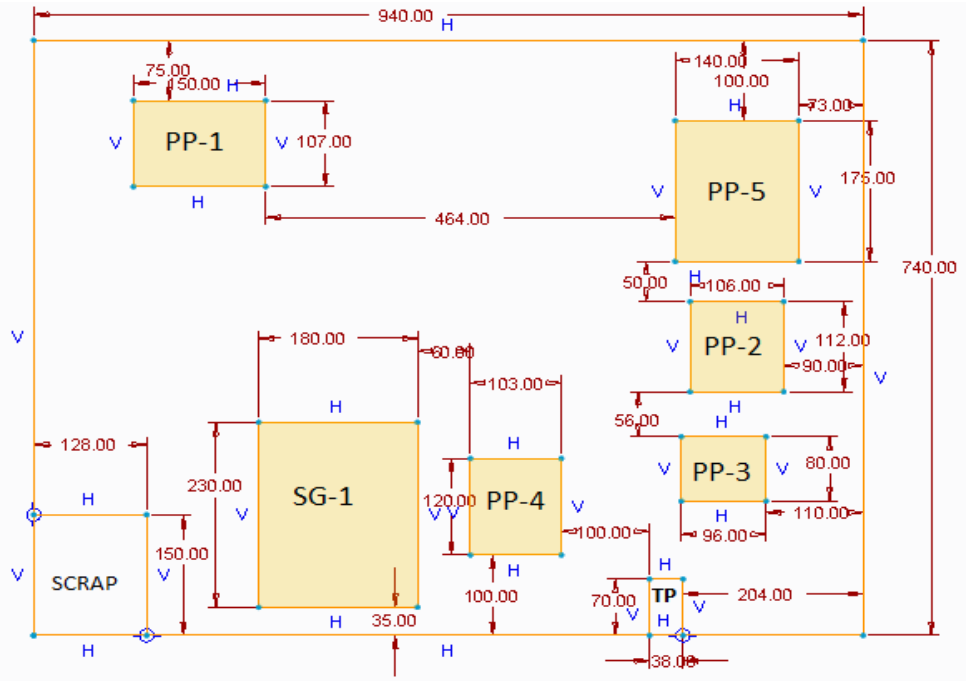


**Figure 4: Proposed New Plant Layout**

All dimensions are in feet.

## EVALUATION METHOD

Overall material flow minimization for productivity improvement and minimizing idle time, material flow has estimated for existing and proposed layouts.

**Table 1: Time Calculation for Existing Plants Layout**

| **1. SHEARING** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Process** | **Observations (Time In Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Avg.** | **Total** |
| Loading | 4 | 5 | 4 | 5 | 5 | 4.4 | 11 |
| Cycle | 3 | 2 | 3 | 2 | 3 | 2.6 | |
| Unloading | 3 | 4 | 4 | 3 | 2 | 3.2 | |
| Total | 10 | 11 | 11 | 10 | 9 | | |
| *Transportation Time From PP -5 to PP-1* | | | | | | | 7 |
| **2. BLANKING** | | | | | | | |
| **Process** | **Observations (Time in Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Average** | **Total** |
| Loading | 6 | 7 | 6 | 8 | 5 | 6.4 | 12 |
| Cycle | 2 | 3 | 3 | 2 | 3 | 2.6 | |
| Unloading | 3 | 3 | 2 | 2 | 3 | 2.6 | |
| Total | 11 | 13 | 11 | 12 | 11 | | |
| *Transportation Time From PP-1 to PP-2* | | | | | | | 11 |
| **3. BENDING** | | | | | | | |
| **Process** | **Observations (Time in Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Average** | **Total** |
| Loading | 5 | 6 | 6 | 5 | 7 | 5.8 | 11 |
| Cycle | 3 | 2 | 2 | 3 | 3 | 2.6 | |
| Unloading | 3 | 2 | 2 | 3 | 3 | 2.6 | |
| Total | 11 | 10 | 10 | 11 | 13 | | |
| *Transportation Time From PP-2 to PP-3* | | | | | | | 3 |
| **4. TAPPING** | | | | | | | |
| **Process** | **Observation (Time in Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Average** | **Total** |
| Loading | 4 | 5 | 5 | 4 | 5 | 4.4 | 10 |
| Cycle | 2 | 3 | 3 | 3 | 2 | 2.4 | |
| Unloading | 3 | 4 | 4 | 3 | 2 | 3 | |
| Total | 9 | 12 | 12 | 10 | 9 | | |
| *Transportation Time From PP-3 to TP-1* | | | | | | | 4 |
| **5. SURFACE GRINDING** | | | | | | | |
| **Process** | **Observation (Time in Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Average** | **Total** |
| Loading | 5 | 6 | 5 | 6 | 7 | 5.8 | 22 |
| Cycle | 10 | 12 | 12 | 14 | 11 | 11.8 | |
| Unloading | 4 | 4 | 5 | 6 | 4 | 4.6 | |
| Total | 9 | 22 | 22 | 26 | 22 | | |
| *Miscellaneous Time* | | | | | | | 40 |
| Total Time required to complete the operation in EXITING PRESS SHOP LAYOUT (in Sec) per unit | | | | | | | 131 |

**Table 2: Time Calculation for Proposed New Plant Layout**

| **1. SHEARING** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Process** | **Observations (Time In Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Avg.** | **Total** |
| Loading | 4 | 5 | 4 | 5 | 5 | 4.4 | 11 |
| Cycle | 3 | 2 | 3 | 2 | 3 | 2.6 | |
| Unloading | 3 | 4 | 4 | 3 | 2 | 3.2 | |
| Total | 10 | 11 | 11 | 10 | 9 | | |
| *Transportation Time From PP -5 to PP-1* | | | | | | | 7 |
| **2. BLANKING** | | | | | | | |
| **Process** | **Observations (Time in Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Average** | **Total** |
| Loading | 6 | 7 | 6 | 8 | 5 | 6.4 | 12 |
| Cycle | 2 | 3 | 3 | 2 | 3 | 2.6 | |
| Unloading | 3 | 3 | 2 | 2 | 3 | 2.6 | |
| Total | 11 | 13 | 11 | 12 | 11 | | |
| *Transportation Time From PP-1 to PP-2* | | | | | | | 2 |
| **3. BENDING** | | | | | | | |
| **Process** | **Observations (Time in Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Average** | **Total** |
| Loading | 5 | 6 | 6 | 5 | 7 | 5.8 | 11 |
| Cycle | 3 | 2 | 2 | 3 | 3 | 2.6 | |
| Unloading | 3 | 2 | 2 | 3 | 3 | 2.6 | |
| Total | 11 | 10 | 10 | 11 | 13 | | |
| *Transportation Time From PP-2 to PP-3* | | | | | | | 3 |
| **4. TAPPING** | | | | | | | |
| **Process** | **Observation (Time in Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Average** | **Total** |
| Loading | 4 | 5 | 5 | 4 | 5 | 4.4 | 10 |
| Cycle | 2 | 3 | 3 | 3 | 2 | 2.4 | |
| Unloading | 3 | 4 | 4 | 3 | 2 | 3 | |
| Total | 9 | 12 | 12 | 10 | 9 | | |
| *Transportation Time From PP-3 to TP-1* | | | | | | | 3 |
| **5. SURFACE GRINDING** | | | | | | | |
| **Process** | **Observation (Time in Sec)** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **Average** | **Total** |
| Loading | 5 | 6 | 5 | 6 | 7 | 5.8 | 22 |
| Cycle | 10 | 12 | 12 | 14 | 11 | 11.8 | |
| Unloading | 4 | 4 | 5 | 6 | 4 | 4.6 | |
| Total | 9 | 22 | 22 | 26 | 22 | | |
| *Miscellaneous Time* | | | | | | | 15 |
| Total Time required to complete the operation in the PROPOSED PRESS SHOP LAYOUT (in Sec) per unit | | | | | | | 96 |

## RESULTS

The total time required to complete the operation per unit has reduced by 35 Sec.

Overall distance travelled (i.e. Material flow) during manufacturing has minimum.

The formation of logistic center eliminates delays, and minimizes transport because of its central location. For better utilization of space, inspection center is constructed.

## CONCLUSIONS

It has been found that, analysis of facility design, such as layout and material handling system is very important in a manufacturing industry. Proper analysis of existing layout design, could improve the performance of production lines. It could decrease bottleneck rate, minimize material handling cost, reduces idle time, raise the efficiency and utilization of labor, equipment and space.

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